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Renewable energy policy in the Republic of Serbia

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ABSTRACT

The aim of this paper is to give insight into the goals, instruments and planned measures of the Serbian Government in the field of renewable energy sources (RES). The method is based on an overview and analysis of adopted laws and regulations and other official documents. The results have revealed that progress has been made in this field in recent years. Midterm targets for the proportion of energy from RES in overall energy consumption have been defined; feed-in-tariffs have been adopted; legislative and socio-economic barriers of increased exploitation of RES have been analyzed and measures and activities were suggested for their resolution. The existing RES-related legislation, however, is imprecise and incomplete. Numerous bylaws, technical standards and guidelines are still outstanding. The key RES-related documents are inconsistent, lack clarity and are insufficiently decisive when implementing specific measures of incentives for production of RES-based energy.

Contents

1. Introduction

In 2009, 42% of the total primary energy requirements of Serbia were covered by import with a growing trend of import dependency [1]. The volume and structure of fossil energy reserves and resources in Serbia are very unfavourable. The reserves of quality energy resources, such as oil and gas, comprise less than 1% of the total energy reserves, while the rest is represented by various types of coal, dominated by more than 92% of low-quality lignite coal [2]. Geographically, more than 76% of lignite reserves are located in the Kosovo and Metohija basin [2].

The unfavourable geographical distribution, as well as the disproportions between geological and exploitation reserves of coal, oil and natural gas indicate the need to utilize alternative, renewable and domestically available energy sources. As defined by the Energy Law of the Republic of Serbia [3]: "renewable energy sources (RES) are the sources which are entirely or partially renewed in nature, such as the energy from water, wind, non-accumulated solar energy, biomass, geothermal energy, etc.". In its official documents, the Government distinguishes a special category of RES – the so-called 'new renewable energy sources (NRES)' which include biomass, hydropower potential of small watercourses with capacity of up to 10 MW, geothermal, solar and wind energy.

Currently, hydroelectricity is the only form of RES that is accurately measured and recorded in the energy balance sheet of Serbia [4]. The total technically achievable hydropower potential in Serbia is about 1.46 million tonnes of oil equivalent (1 Mtoe = 4.18 × 10^{16} J), of which about 60% is currently utilized [4]. The technical energy potential of NRES in Serbia equals 3.4–4.3 Mtoe depending on data source [4,5], or around 22–28% of primary energy

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consumption in 2008. Approximately 63% of the total NRES potential lies in biomass. The technical potential of small watercourses was estimated to be 0.6 Mtoe which is in the line with solar energy potential. The share of geothermal and wind energy sources is less significant, comprising around 4 and 5% of total NRES potential, respectively [4,6].

In the first half of 2010 the exploitation of NRES in Serbia was negligible. The number of existing facilities for NRES exploitation, as well as their annual energy output, is negligible; while investments into NRES facilities so far are small and mainly of domestic origin. Financial effects from exploitation of existing RES facilities are also minor on national level. The implemented technology and equipment in these facilities does not meet European Union (EU) standards, which has negative impact on reliability, production stability, energy efficiency and maintenance.

The reasons for the negligible share of NRES in total energy consumption in Serbia include problems with planning regulations, poorly thought out support mechanisms and general lack of political will. In EU the main instruments for promoting RES are feed-in tariffs, quota obligations, tenders and tax exemptions. In most cases countries decide for one of these instruments and build it into other political instruments such as subsidy programs, soft loans, tax allowances, exemptions of renewable energy from energy taxes, information campaigns, etc. [7,8].

The aim of this paper is to give insight into the goals, instruments and planned measures of the Serbian Government in the field of RES and is based on an overview and analysis of adopted laws and regulations and other official documents. The timing of this paper is not accidental, since at the end of 2009 the Government of Serbia adopted three important decrees which are intended to regulate the status of producers and improve the economic viability of the production of energy from RES and enhance private investments in this sector. These decrees mark a turning point in the Governments attitude towards RES.

The paper is organized into 5 sections. After an introduction Section 2 highlights the international legal obligations of Serbia regarding the production and exploitation of RES, and the position of RES in Serbian strategic documents is described. Section 3 offers a brief overview of the specific goals and measures that existing laws, regulations and guidelines have set out to encourage investment in renewable energy. In Section 4 the barriers that limit increased utilization of RES in policy context are discussed, and different measures are proposed that could complement existing policies and promote RES development more effectively and efficiently. Section 5 concludes the paper.

2. International obligations and strategic orientation of Serbia in the domain of RES

Serbia ratified the Kyoto Protocol in 2007. However, its greenhouse gas (GHG) emission was by then reduced far below the average emission reduction targets set by the Protocol for industrialized countries. This was mainly due to the economic restructuring and decrease of industrial activities in the 1990s. This resulted in very low political pressure on Serbia on the global level. More influential are the stipulations set by the European Union.

Serbia ratified the South-East European (SEE) Energy Community Treaty, which exists between EU and the countries of SEE, in 2006 therefore accepting the obligation to apply Directive 2001/77/EC which promotes production of electricity from RES, as well as Directive 2003/30/EC which promotes utilization of biofuels and other RES-based fuels in transportation sector [9]. These and other EU directives on RES give all states with applications for EU accession targets for their RES development and require establishment of adequate measures for their attainment. Whether the European stipulations are reached mainly depends on the willingness of each state, considering the targets are only non-binding reference values (so-called indicative targets) [10]. Serbia was obliged to draw up a plan for the practical implementation of these directives by mid 2007.

Directive 2009/28/EC of the European Parliament and of the Council on the promotion of the use of energy from renewable sources, which appends and subsequently repeals Directives 2001/77/EC and 2003/30/EC, sets the national target shares of RES in total energy consumption for EU members in the sectors of electricity production, heating and cooling and transport sector.[1] Serbia has not yet defined a start period for the implementation of Directive 2009/28/EC, but it is to be specified during future negotiations and harmonization with other members of the SEE Energy Community Treaty. In addition, as one of the founders and member of the International Renewable Energy Agency (IRENA) since 2009, Serbia accepted additional obligation to stimulate production of RES-based electric energy.

The strategic orientation of Serbia towards increased exploitation of RES was identified in several Governmental documents:

- The Energy Sector Development Strategy of the Republic of Serbia by 2015 (adopted in 2005) emphasizes that Serbia has special advantages and requirements when it comes to organized exploitation of RES through decentralized production of electricity and thermal energy (by combustion of biomass and collection of solar radiation) which could be used to meet local consumption, while the surplus could be redistributed within the national power grid [2].
- The National Sustainable Development Strategy of the Republic of Serbia (adopted in 2008) defines national priorities for sustainable development, among which are the incentives for usage of RES in order to protect and improve the environment, as well as to use RES in a rational manner so as to make them available to future generations [11].
- The National Strategy for Economic Development of Serbia 2006–2012 (adopted in 2006) also prioritizes selective usage of RES with the goal to slow down the import rate of energy, decrease the negative impact on the environment, create business opportunities for domestic industry and increase local employment. It also highlights the importance of alignment with EU practices and legislations in this field [12].
- The National Environmental Protection Program (adopted in 2009) recognizes the importance of substitution of fossil fuels and non-renewable energy sources with RES in order to protect the environment [13].

3. Present legal framework and incentives for the production and exploitation of RES in Serbia

3.1. RES-related legislation

Prior to 2010 the National Assembly of the Republic of Serbia adopted the following RES-related legislation:

- Energy Law (Official Gazette RS 84/04);
- Energy Sector Development Strategy of the Republic of Serbia by 2015 (Official Gazette RS 44/2005);
- Program for the Realization of the Energy Sector Development Strategy of the Republic of Serbia by 2015, for the period 2007–2012 (Official Gazette RS 17/07 and 73/07);

[1] The goal of Directive 2009/28/EC is for RES energy to comprise at least 20% of the total consumption of energy in EU by 2020, as well as to ensure that consumption of RES energy in the transport sector is at least 10% of the total fuel consumption in EU by 2020.

- Decree on Amendments and Supplement on the Program for the Realization of the Energy Development Strategy of the Republic of Serbia by 2015, for the period 2007–2012 (Official Gazette RS 72/09);
- Decree on the Requirements for Obtaining the Status of the Privileged Electric Power Producer and the Criteria for Assessing Fulfilment of these Requirements (Official Gazette RS 99/09);
- Decree on Measures of Incentives for the Production of Electricity Using Renewable Energy Sources and Combined Electric and Thermal Power (Official Gazette RS 72/09).

The Energy Law defines a framework for the ending of the Serbian Electric Power Industry's monopoly, improving competition in power generation and opening up the energy market to all producers [14]. The Energy Law legalised the establishment of new enterprises in the energy sector, including the investment in production of electrical energy in NRES power plants. According to this law one of the prominent measures to ensure realization of long-term goals in the energy sector is creating conditions which stimulate usage of NRES and combined production of electrical and thermal energy. The Energy Law introduces the category of *privileged producers* of electrical/thermal energy which use NRES or waste for energy production. The most important feature of privileged producers is the priority status they have on the organized energy market against other producers, provided that their offers are under equal conditions. Secondly, they are entitled to subventions, tax, customs and other exemptions, which are necessary for the profitability of RES-based electricity production.

The Energy Sector Development Strategy of the Republic Serbia by 2015 (hereafter Energy Sector Strategy) was adopted by the National Assembly in 2005 and it names the selective use of NRES as one of its five priority strategies. The strategy defines the principles and gives guidelines for the preparation of the Program for selective use of NRES which would establish a program-oriented framework for all the activities aimed at increased and efficient use of NRES in a 6-year period by 2012. In order to realize this Program, the Energy Sector Strategy recognises the importance of stimulation and support of strategic initiatives in the area of investment in the exploitation of NRES. In particular, it recommends financial incentive measures for private investment in projects of energy efficiency and selective use of NRES including the establishment of the National Energy Efficiency Fund and other funds for financing activities in the field.

The Strategy proposes gradual increase of NRES production, which by 2015 has to reach 0.4 or 1.1% of the total consumption of primary energy, depending on the achieved rate of economic/industrial development.

In 2007, the Government passed the Program for the Realization of the Energy Sector Development Strategy of the Republic of Serbia by 2012 (hereafter the Energy Sector Development Program) [15]. The basic goal of the program in respect to NRES is creation of favourable conditions for investment into NRES technologies through measures aimed at overcoming barriers that currently prevent its increased utilization. According to the Energy Sector Development Program the measures and activities which are necessary to increase NRES usage are classified into three groups focused on the following goals:

- The first goal is the creation of a stimulating regulatory framework for higher usage of NRES. In that respect it advocates changes and amendments to a number of existing, as well as adoption of further laws and decrees.
- The second goal is the adoption and implementation of financial measures in order to stimulate RES usage. Within the measures, the Energy Sector Development Program suggests the establishment of a National Energy Efficiency Fund for the funding of RES-related projects. In addition, the Fund should be used for supporting R&D, giving favourable loans and building and equipping certification laboratories. It also envisages introduction of subventions, tax-, customs-, and other exemptions, as well as measures to promote RES usage through creation of pilot and demonstration facilities.
- And finally, the third goal is adoption and implementation of non-financial measures to stimulate RES usage, of which especially important are formation of RES database and cadastre, simplification of administrative procedures for obtaining permits for building and using RES-fuelled plants, as well as broadening knowledge, promotion of good practices and education of the wider population.

The Energy Sector Development Program proposes building of NRES plants of total installed electrical and thermal capacity of approximately 90 and 200 MW, respectively. It also envisages production of 80,000 metric tonnes of biofuel in the period 2007–2012. The 6-year targets for the installation of planned electrical and thermal capacities of NRES plants are shown in Table 1.

Considering none of the planned plants were built and very few predicted activities and measures were carried out by the end of 2009, in November the same year the Government drew up a decision on the amendments and supplements to the Program for the Realization of the Energy Sector Development Strategy of the Republic of Serbia by 2012 (hereafter Amendment Energy Sector Development Program) [5]. The initially adopted policy targets were modified and the new goal is to increase the share of electricity produced from RES from 30.3% in 2007, to 32.5% of the total national consumption of electricity in 2007 by 2012. The goal is to be realized by increasing RES-based production of electricity by 739 GWh in 2012, of which 47% is to originate from NRES. Apart from this, the Amendment Energy Sector Development Program envisages at least 2.2% market share of biofuels in the total fuel consumption in the traffic sector, calculated based on energy content of the fuels.

To realize this goal by 2012, it is planned to attract and engage private sources of funding totalling 200 million € to build NRES power plants of total capacity of 102 MW of electric power. In the period 2009–2012 it is planned to build several small hydropower (in total 45 MW), wind (in total 45 MW), solar photovoltaic (in total 5 MW), biomass (in total 2 MW) and biogas plants (in total

Table 1
Planned capacities of NRES plants for the period 2007–2012 [15].

	Unit	2007	2008	2009	2010	2011	2012	Total
Small hydropower plants	MW	1.4	4.3	7.0	13.3	15	20	61
Biomass boilers	MJ/s	5	15	15	15	25	35	110
Biogas (electricity)	MW	0	0	0	0.5	1	2	3.5
Liquid biofuel	10^3 tonnes		20	30	40	60	80	–
Geothermal energy	MJ/s	2	8	20	20	20	22	92
Wind plants	MW	0	0	2	8	8	8	26
Solar energy	10^3 m^2	0	1.3	2.7	4.0	6.0	8.0	22.0

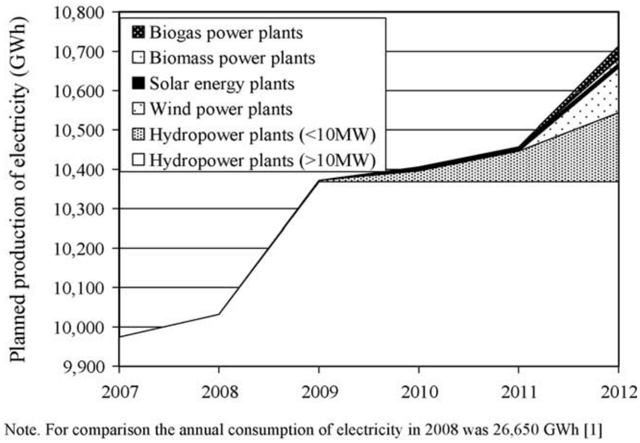


Fig. 1. Planned production of electricity from RES in Serbia for the period 2007–2012 [5].

5 MW) whose expected annual production of electricity is shown in Fig. 1.

In 2009 the National Assembly adopted a decree which defines Requirements for Obtaining the Status of a Privileged Electricity Producer as well as the Criteria for Assessing Fulfilment of these Requirements [16]. According to this decree, the status of privileged electricity producer is granted to producers who:

- use RES or communal waste in the process of power production,
- produce power in small power plants (up to 10 MW), or
- simultaneously produce electrical and thermal energy.

The Decree on Measures of Incentives for the Production of Electricity Using Renewable Energy Sources was adopted by the end of 2009 and it precisely defines measures of financial incentives for the production of electricity using renewable energy sources and the purchase conditions [17]. The most important aspect of this decree is that it defines the feed-in tariffs for electricity produced by NRES power plants. Furthermore, it defines the conditions of the contract between buyers and the suppliers of electricity and provides a method for the calculation of additional costs arising from the purchase of electricity from the RES suppliers. Feed-in tariffs, in eurocents (€c) per kWh, for various types of power plants according to this decree is presented in Table 2.

The quantity of produced electricity for which the feed-in tariffs from Table 2 apply is limited to particular types of NRES. Wind power plants are entitled for these prices only up to 450 MW of installed electric capacity (on aggregate). Power plants using non-accumulated solar energy qualify for such prices only up to 5 MW of total installed electric capacity. Feed-in tariffs are applied from the date of application or request for renewal of privileged status, until the end of validity of this decree, that is, until December 31st 2012.

The buyer of electricity can be any organization involved in the distribution and trade of electricity. They are contracted by privileged producers for a period of 12 years. The buyer is obliged to take over the delivered quantity of electricity from the privileged producers which fulfil requirements of this, and some other decrees. In return, the buyer is allowed the compensation of additional costs which include increased costs of balancing (grid maintenance) and costs of electricity bought from the privileged producers (margin between the regular buying tariff and, the higher, feed-in tariff). The buyer's costs incurred by the feed-in tariffs for RES electricity are compensated from the sales profits.

3.2. Main institutions in the RES sector of Serbia

There are several institutions in Serbia that are active, directly or indirectly, in the process of defining the conditions and rules for doing business in the energy production sector. In most cases the

Table 2
Feed-in tariffs for various types of power plants in Serbia, in eurocent (€c) per kWh [17].

No.	Power plant type	Installed power (MW)	Incentives – feed-in tariff (€c/kWh)
1.	Hydro power plants		
1.1		<0.5	9.7
1.2		0.5–2	10.316 – 1.233*R*
1.3		2–10	7.85
1.4	On existing infrastructure	<2	7.35
1.4	On existing infrastructure	2–10	5.9
2.	Biomass power plants		
2.1		<0.5	13.6
2.2		0.5–5	13.845 – 0.489*R*
2.3		5–10	11.4
3.	Biogas power plants		
3.1		<0.2	16.0
3.2		0.2–2	16.444 – 2.222*R*
3.3		>2	12.0
4.	Landfill gas power plants and power plants running on gas from communal waste water treatment plants		6.7
5.	Wind plants		9.5
6.	Solar energy plants		23
7.	Geothermal energy plants		7.5
8.	Power plants for combined production running on fossil fuels		
8.1		<0.2	$C_0 = 10.4$
8.2		0.2–2	$C_0 = 10.667 - 1.333R$
8.3		2–10	$C_0 = 8.2$
8.4	on existing infrastructure	>10	$C_0 = 7.6$
9.	Waste power plants		
9.1		<1	9.2
9.2		1–10	8.5

Note: for combined heat and power plants which are fuelled by natural gas, the feed-in tariff is defined according to the following formula: $C = C_0(0.7G/27.83 + 0.3)$, where C is the new feed-in tariff, C_0 is the reference feed-in tariff which is defined based on the price of natural gas for retail dealers of natural gas; G – new price of natural gas for retail energy dealers. R is the installed electric capacity of the plant in MW.

organization, jurisdiction and activity of these institutions is synchronized with the existing institutional framework of the EU [4].

The main institutions and their responsibilities within the Serbian energy sector involved in the creation of a legal framework for the production and exploitation of RES-based electricity are listed bellow [4,18].

- *Ministry of Energy and Mining* (*MEM*) – responsible for the Government's energy policy, taking care of the preparation and adoption of energy-related legislation and bylaws, the energy strategy and energy budget. It is responsible for issuing the Energy Licence for power plants with installed capacity over 1 MW. The RES department of this ministry is responsible for biofuels (biomass, biodegradable waste and biogas), small hydropower plants, wind, solar and geothermal plants. The Ministry has 70 employees.
- *Ministry of Environment and Spatial Planning* – responsible for environmental protection and sustainable use of natural resources, environmental monitoring, climate change and protection of ozone layer, air and water quality monitoring and protection and issuing permits and licenses for developments of special importance for the state. It is also responsible for spatial organization of power plants on national level, while on the local level this task is delegated to local authorities and their offices. It has 380 employees.
- *Ministry of Agriculture, Forestry and Water Management* – responsible for the regulations in the field of agricultural production and forestry related to RES from biomass and determining water distribution and usage. It has 67 employees.
- *Ministry of Science and Technological Development* – responsible for research, development and promotion of innovative technologies. It has 53 employees.
- *Energy Agency* – approves tariff systems for consumers of electricity and tariff systems for connection to and usage of the national grid, it defines the elements of the tariff system that define the price of electricity, as well as the price of thermal energy produced in thermal power stations and heating plants. The Agency also issues and renews licenses for organizations involved in the production and distribution of energy. The Agency has 35 employees.
- *Energy Efficiency Agency* – tasked to improve energy efficiency and increase usage of renewable energy. The Agency prepares and proposes programs and measures, synchronizes and encourages activities aimed at rational energy usage and savings, as well as increase of energy efficiency in all areas of consumption. Its task is to collect data on energy consumption, recommend procedures for obtaining financial support and technical assistance, including monitoring, it proposes projects of financial support and overseas project delivery, and in collaboration with MEM it establishes cooperation with domestic and foreign organizations. The Agency has 12 employees.
- *Electric Power Industry of Serbia* – a state-owned public enterprise for the production and distribution of electricity. In Serbia there are currently no private companies involved in this field (except small hydropower plants and some in-house industry facilities).

4. Identified obstacles of increased usage of RES in Serbia

There are a number of reasons why NRES in Serbia are used in insignificant quantities in 2010. These reasons can be broken down into three groups:

- lack of adequate legal and technical regulations to create stimulating environment for RES exploitation and investment into RES facilities,
- overall socio-economic environment which currently does not favour investments into RES, and
- shortage of experts and industry professionals in the field.

The existing RES-related legal framework is imprecise and incomplete. Neither the Energy Law, nor other laws distinguish biofuel as a special fuel category which can be used in transport. Therefore, they do not provide necessary legal framework for its exploitation, i.e. for implementation of Directive 2003/30/EC. In addition, there are no clearly defined obligations for operators of power distribution system to prioritize RES producers when connecting to the national grid, which is one of the obligations defined by Directive 2001/77/EC. Although the Energy Law obliges the electricity distributors to give priority status for the power plants based on NRES under equal conditions, it fails to specify what it meant by equal conditions allowing a buyer to put various restrictions on the energy suppliers from RES. The necessity to amend the Energy Law and its clarifications in regards to the definition of biofuels and responsibilities of power distribution system operators was recognized in 2007 [15] but no improvements have been achieved to this day.

Numerous bylaws, technical standards and guidelines in the field of RES utilization are still outstanding. In particular, the lack of a document outlaying procedures and technical prerequisites for connecting RES power plants to the national grid is obvious. There is lack of technology and equipment standards, as well as regulations on design, manufacture, control and assembly of devices which utilize RES. Currently there are no accredited certification laboratories for RES technologies in Serbia. Moreover, there are no regulations which provide standardized methods for the exploitation of RES-fuelled plants.

Although the establishment of the National Energy Efficiency Fund was outlined by the Energy Sector Strategy in 2005, it has not been realised by 2010, nor were other funds provided for the long-term funding of RES-related projects. At this moment it is not clear from which financial sources the higher price of green electricity (feed-in tariffs) will be paid, nor is the mechanism for the payment of feed-in tariffs defined.

Potential investors into RES-fuelled power plants are forced through intricate administrative procedures which require a large number of permits from various institutions.[2] The Law on Public Enterprises and Performance of Business Activities of General Interest defines the production of electricity as an activity of public interest. This means that the procedure for starting production in small power plants is the same as for the power plants above 10 MW. It is necessary to acquire a government-issued Act which confirms that the intended activity is of public interest. Additional difficulty is created by the unknowns regarding the quantities of RES in particular locations, which preclude registration of such locations in the regional and local land-use master plans, as well as lack of clear methodology for determination of theoretical and techno-economic potentials of particular types of RES.

The Energy Sector Strategy and the Programs for its implementation, as the key RES-related plan documents, are inconsistent, lack clarity and are insufficiently decisive when implementing

[2] Experience of an investor corroborates this thesis: putting into operation a small hydropower plant, capacity of 42 kW required 40 different acts, permits, approvals and other authorizations. These documents were issued by various administrative bodies on local and national level, while the issuing procedure was protracted. For example, it took the investor three years to obtain a building permit which, at the time of building this hydropower plant, was issued by the local council. Due to some unresolved proprietary issues, special problems arose when buying up neighbouring plots which were necessary to build the accumulation lake [18].

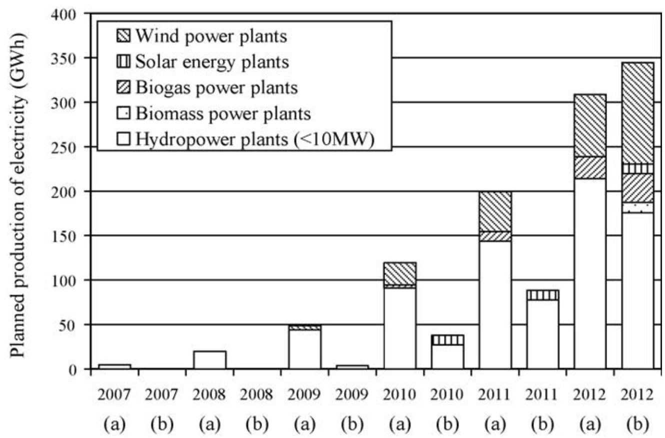


Fig. 2. Planned production of electricity in NRES-fuelled plants in the period 2007–2012 according to the Programs for the Realization of the Energy Sector Development Strategy from 2007 (a) and 2009 (b) [5,15].

specific measures of incentives for production of RES-based energy.

Inconsistency is notable when observing strategic and program goals for target levels of RES share in overall consumption of energy and the planned dynamics of introducing RES exploitation. The Amendment Energy Sector Development Program amends the initial program for the implementation of energy strategy in a way that the goals differ not only by the planned dynamics of RES introduction and the total planned new RES production, but also in the way these two documents prioritize particular sources of renewable energy (Fig. 2). Interestingly, the targeted 2.2% increase in the share of electricity from RES in national electricity consumption by 2012 in the Amendment Energy Sector Development Program was formulated assuming that the consumption of electricity would not increase in the period from 2007 to 2012. According to the Energy Sector Strategy, however, in the same period a 7% increase in electricity consumption is predicted, which would actually lead to the relative decrease in the share of electricity from RES in 2012.

The lack of clarity is primarily attributed to the Energy Sector Development Program. In this program, production capacities of plants which use various types of NRES are expressed in different units (see Table 1) which prevents calculation of aggregate value of the total installed power of NRES-fuelled plants. This was rectified by the amendments and supplements of the Amendment Energy Sector Development Program in 2009, which used unified measures to express planned production of electricity and production capacities of different plants – planned production of electricity was expressed in kWh/year, while the installed power of plants was expressed in MW.

Insufficient decisiveness to bring specific measures of incentives for production of RES-based energy is inherent to majority of documents which regulate RES usage, which can be seen from the wording of these documents. For example, the draft version of the Energy Sector Development Program contained the following measure: 'By the beginning of 2010, passenger and goods transport can be performed by operators whose share of liquid and solid biofuels in their total consumption of oil and oil derivatives in the previous year is at least 15%' [19], while in the final version of the Energy Sector Development Program this same measure was much milder and vaguer: 'Among other things, it is necessary to consider the possibility of stimulating the usage of biofuels in road transportation, so that by the beginning of 2010, public transport would be allowed to operators whose share of liquid and gaseous biofuels in their total consumption of oil and oil derivatives in the previous year is above some defined percentage'.

In depth analysis of socio-economic environment for investments and explorations of NRES was out of the scope of this paper, however, some of the main obstacles in this regard should be mentioned: (i) significantly lower price of electricity (4.3 €c/kWh) and thermal energy from coal as compared to NRES-derived energy; (ii) general lack of public awareness of environmental protection and sustainability, as well as lack of individual initiative and entrepreneurship; and (iii) half-hearted and insufficiently defined attitude of the Serbian Government towards European integration.

In Serbia, there is an insignificant number of experts in various areas which are competent for the introduction and usage of renewable energy sources. A previous analysis has showed that Serbia needs at least 240 highly qualified professionals in this field [19]. This comprises only 1% of the 24,000 workers on NRES-related jobs in Serbia by 2015, which is envisaged by the Energy Sector Development Program. With the implementation of the National Program of Energy Efficiency of the Ministry of Science and Technological Development, which stipulated funds for universities and institutes in Serbia to work on projects of energy efficiency and use of alternative and renewable energy sources, certain advancement was achieved in the field of research, development and demonstration in this field [20]. However, the level and extent of education is still not satisfactory. At the Serbian Universities RES topics are taught within traditional scientific and engineering disciplines, mainly at encyclopaedic level. In addition, NRES education is primarily provided in solar and biomass energy, while marginalizing other forms of NRES [21].

5. Conclusions

Serbia has significant potential for the production of energy from RES. Utilization of the gross technical RES potential would meet around one third of the overall primary energy consumption in Serbia. Currently less than 20% of this potential is used, mainly in the form of hydropower. One of the main reasons for the negligible share of NRES in total energy consumption in Serbia is lack of stimulating legal and technical regulations and framework.

The Serbian Government has, in recent years, made a progress in this domain by adopting a number of legislations to improve the economic feasibility of energy production from RES. The Energetic Law legalised the establishment of new enterprises in the energy sector ending the monopoly of the Serbian Electric Power Industry. Several strategic documents have recognized the importance of RES and put midterm indicative targets on the share of energy from RES in total primary energy consumption. Barriers for the increased utilization of RES were analyzed and specific actions and measures to overcome these were suggested. In 2009, the Government has adopted favourable feed-in-tariffs aimed at making energy production from RES more attractive for potential investors. However, there is a lot of work still to be done. The RES goals should be stated in more transparent manner and they should be synchronized between various strategic and program documents. Number of bylaws, technology and equipment standards as well as regulations on design, manufacture, control and assembly of devices which utilize RES are still missing. The most important obstacle is lack of a national fund from which the increased costs of RES energy production and the adopted feed-in-tariffs would be financed.

Apart from the missing policy regulations two other factors might slow down the realization of RES-related policy targets. These are the present socio-economic and political environment, which is unfavourable for capital intensive investments in general, and lack of industrial and professional expertise in the area of RES management. As opposed to policy making, the changes in socio-economic environment and training of a critical number of experts

require long-term and midterm effort, which imposes significant limitations to the future exploitation of RES in Serbia.

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